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ABSTRACT

Students who were awarded university fellowships for their first year of study at a major research university were compared to nonfellowship students. The students' completion of the Ph.D. and the time required to obtain the degree were assessed. Data for about 3,200 Northwestern University students were analyzed. Three models were developed for organizing the data on which student performance was evaluated. In addition to a long-term longitudinal approach for tracking students' academic careers, a short-term longitudinal approach covered students' yearly progress. The long-term approach was used for the entering classes of 1972-1973 through 1976-1977, while the short-term approach started with the class of 1978-1979. The third model used a retrospective approach incorporating data for all degree recipients since 1978. Information is presented on the length of time to complete a Ph.D. and degree completion rates for the following departments: anthropology, art history, economics, English, German, history, mathematics, philosophy, physics, political science, psychology, Spanish, Slavic languages, and sociology. Students awarded fellowships in their first year did not consistently outperform other students, except for students in the Department of English. (SW)

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A STUDY OF THE EFFICIENCY OF THE FELLOWSHIP SELECTION PROCESS AT A MAJOR RESEARCH UNIVERSITY

Paper Presented at
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Abstract

The objective of this study is to determine whether those students who are awarded university fellowships for their first year of study at a major research university are more likely to complete the Ph.D. and to do so in a shorter period of time. The data does not provide strong support for the hypothesis that university fellows outperform nonfellows. Several alternative explanations are discussed and additional research is suggested.

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A STUDY OF THE EFFICIENCY
OF THE FELLOWSHIP SELECTION PROCESS
AT A MAJOR RESEARCH UNIVERSITY

Objective

Financial aid, often in the form of fellowships, is utilized by graduate schools as a method of recruiting outstanding applicants to their programs. The recently released report of the Commission on Graduate Education at the University of Chicago (1982) and the ongoing work of the Graduate Research Project of the Consortium on Financing Higher Education (COFHE) demonstrate the role of financial aid in attracting prospective students. However, these research findings do not address the issue of whether the students attracted by the award are actually performing at a higher level of quality than those students not so recruited. The objective of this study is to determine whether those doctoral students who are awarded university fellowships for their first year of study at a major research university are more likely to complete the Ph.D. and to do so in a shorter period of time.

Perspectives

Fellowships funded by university appropriated monies currently constitute approximately 20% of the primarily merit based financial aid available to graduate students at Northwestern

University. The distribution of the other forms of financial aid is done through individual departments and varies considerably from department to department based on the availability of the various sources --research and teaching assistantships, training grants and other departmental funds--and the nature of the particular department and discipline. Since the university fellowships are allocated and distributed through The Graduate School they have become significant in shaping a university-wide financial aid policy based on fellowships in the first year and departmental support afterwards. The importance of the university fellowship has increased in the last decade as the large numbers of fellowships provided by the Federal Government have all but disappeared.

Over the last decade The Graduate School has used the university fellowships to an increasing degree as a part of the process of recruiting potentially outstanding students to doctoral programs at Northwestern University. Fellowship offers are made to applicants based on the recommendations of a university-wide committee broadly constituted to represent the various academic divisions of The Graduate School. The objective of this process it to identify those among the applicants with the greatest potential for outstanding performance and by offering these individuals a prestigious

form of financial aid encourage them to matriculate at Northwestern University. There is a general consensus among the Graduate Faculty that this fellowship award process is appropriate and a feeling that it has been accomplishing its objectives. As a consequence of this attitude, the fellowship competition has been expanded in recent years so that it now covers virtually all departments within The Graduate School. Despite the general acceptance of the procedure, there have been no comprehensive studies to evaluate the accuracy of the premise that the students selected by the award committee are outperforming students not selected. The objective of this research is to test these assumptions.

The primary theoretical issue in evaluating the fellowship selection process is identifying the criteria of performance against which the selection process should be evaluated. Although there is an extensive research literature concerned with this issue for undergraduate students, a similar research base is not available for graduate education.

The bulk of the research pertaining to the appropriate measures of success against which to evaluate a selection process has arisen as a result of the work of the Graduate Record Examination Board (GREB) in conjunction with their

Cooperative Validity Service. Most of the validity studies such as the ones by Burton and Turner (1983), Livingston and Turner (1982), Kingston and Livingston (1981), and Wilson (1979), utilize first year grade point average as the performance criterion. This approach has been criticized on the grounds that first year grades reflect only one aspect of graduate education and are, therefore, an inadequate measure of student performance.

As a result of the criticism of the validity studies the GREB commissioned several projects designed to identify the relationship between GRE scores and a broader set of performance measures. Schrader (1980, 1978) relates test scores to several measures of professional performance. Hartnett and Willingham (1979) provide a very useful discussion of the difficulty in determining an encompassing criterion against which to measure successful performance. They outline the deficiencies of each of the commonly used criteria and conclude that often programs are evaluated against inadequate criteria. Clark and Centra (1982) using a path analysis approach clearly demonstrate the complexity of the relationship between ability and performance.

Two research papers produced outside of the Educational Testing Service are very helpful in reducing the issue to manageable proportions. Klitgaard (1979) in a study of the impact of declining enrollments on the production research Ph.D.'s concludes that it is not possible to identify at the time of admission those individuals who will become "great academics." This is hardly surprising in light of the uniformly high level of measured ability and small dispersion in admission criteria for students admitted to doctoral programs at major research universities. Acceptance of Klitgaard's position requires a narrowing of the criteria of performance. There is need for an alternative approach somewhere between the myopic reliance on first year grades as utilized by the GRE validity studies and the "great academics" approach rejected by Klitgaard. In a careful evaluation of the Ford Foundation's Graduate Fellowships Program Breneman (1977) relies on measures of degree completion rates and time to degree to assess the efficiency of the Foundation's approach. These measures are appropriate for Breneman's task since the objective of the Ford Foundation was to provide an incentive that would encourage the establishment of a four year Ph.D. in the social sciences and humanities as was, and is, the case in the sciences.

The caveats provided by the research cited have been instrumental in designing this study. Rather than attempting to investigate individual selection criteria this study will focus on the end result of the fellowship selection process and compare the performance of those to whom fellowships have been awarded with those not awarded fellowships. Since the objective of the selection committee is to identify successful graduate students, the performance criteria identified by Breneman--successful completion of the Ph.D. and time required to complete the doctorate--will be used in this study.

Method of Analysis

There were no standard models which could have been relied upon for organizing the data on degree completion rates and length of time required to complete a Ph.D. Consequently, models had to be developed specifically for this project. The task was complicated by the extended period of time usually required to complete a Ph.D. degree. No single model proved comprehensive enough to reflect fully the complexities of the process. Therefore, three different models were developed for organizing the data upon which student performance would be evaluated.

The first model utilizes a long-term longitudinal approach which tracks students over their entire academic careers. Starting with the entering classes of 1972/73, the academic progress of each student in the cohort is recorded. Degree completion rates three, four, five, six, etc., years since matriculation are calculated. A similar procedure is followed for the entering cohorts in 1973/74, 1974/75, 1975/76 and 1976/77. The results for each department are summed separately for fellows and nonfellows. The advantage of this approach is that it provides a record of the experience of students over their entire academic career. However, it examines behavior that has occurred, at least in part, in the past and which may no longer be relevant.

The second model utilizes a short-term longitudinal approach which provides a detailed year to year progress record of students from recent entering classes. Starting with the entering cohort of 1978/79, two year and candidacy survival/attrition rates are calculated. These data are then aggregated and survival rates are computed. This approach provides a record of student experience based on data for recent years. Its weakness is that it does not allow for evaluation over an entire graduate career, lacking particularly any indication of the fundamental measure of success, i.e., the completion of the Ph.D.

The third model uses a retrospective approach incorporating data for all degree recipients since 1978. Length of time to complete the degree is computed for those students who were awarded fellowships for their first year and for those who were not. The retrospective model is useful in that it provides insight into successful graduate students, but tells nothing about those who were unsuccessful.

Since each of these models has weaknesses as well as strengths, it is necessary to utilize a combination of approaches to measure performance. Each of these measures is applied separately to fellows and nonfellows on a department by department basis.

The most appropriate unit of analysis for most questions relating to graduate education is the individual department or program. The requirements of each department and its internal culture coupled with the idiosyncratic nature of individual disciplines results in a diverse system of graduate education. This diversity produces significant differences between departments particularly in relation to retention rates and length of time required to complete a degree. There are, however, circumstances under which the number of students in a particular category is so small that

some method of grouping departments is required. When those situations arise two criteria are used for assigning departments to groups. The first is the length of time required to complete the degree as measured by all degree recipients from 1970 to 1983. The other criterion is the methodology of the discipline, i.e., humanistic, social scientific or scientific.

Data Sources

In order to conduct this study and a series of related projects a comprehensive data base was constructed containing records for over 57,000 applicants to The Graduate School of Northwestern University since 1972. Among these 57,000 cases are records for approximately 32,000 admitted applicants and over 10,000 matriculants. The data base was assembled by combining information from several computerized information systems supplemented with hard copy records. Admission records were obtained from archived computer tapes were combined with data from an on-line student information system. Financial aid data were the most difficult to obtain being kept as hard copy records in individual departments, as hard copy in The Graduate School, in an on-line student financial aid system as well as partially in the University's payroll system. The end result of this effort is a fully integrated

data base providing the necessary information to answer a wide range of questions. This type of data base is unique among graduate schools.

Currently the fellowship competition includes all graduate departments and programs in the College of Arts and Sciences, School of Speech and the Technological Institute. Departments in the Technological Institute were excluded because they were not part of the competition for the entire period of the study. For similar reasons the Department of Chemistry, one of the largest departments in Arts and Sciences, was excluded. Other Arts and Science departments excluded were in the biological sciences where the departments underwent a major reorganization during the period of study. The departments in the School of Speech were excluded because data for the early portion of the period under study made no distinction between individual departments preventing the application of the disaggregated approach employed with the other data. After excluding several small departments and programs, what remains is a sample consisting of 14 departments--Anthropology, Art History, Economics, English, German, History, Mathematics, Philosophy, Physics, Political Science, Spanish, Slavic Languages, and Sociology. The resultant data consists of approximately 3,200 cases.

Table 1 provides the basis for combining departments so that the number of cases, particularly for University Fellows are large enough for meaningful analysis. Based on the criterion described above, the three language departments are grouped together, as are Art History and History, and Political Science and Sociology.

Results

Table 2 presents the results from the long-term longitudinal approach. Two models are used in computing the percentage of entering students who complete the Ph.D. Model A presents the aggregate degree completion rates for the entering classes 1972/73 through 1976/77. The percentages reported in the table reflect an aggregation process in which entering cohorts with unequal years since initial matriculation are combined. Appendix Tables A1 through A9 display the raw data and the method of computation. Using Table A1 as an example, 46.7 percent of the (seven of 15) University Fellows who matriculated between 1972/73 and 1976/77 received Ph.D.s by August of 1983, the most recent degree confirmation date. As the table illustrates, entrants from the 1976/77 cohort have only had seven years in which to reach the Ph.D. It is certainly possible that additional members of the 1976/77 cohort will eventually receive a Ph.D. As a consequence, the degree

TABLE 1

LENGTH OF TIME TO COMPLETE A PHD
SELECTED DEPARTMENTS WITHIN ARTS AND SCIENCES
THE GRADUATE SCHOOL
NORTHWESTERN UNIVERSITY
1970 - 1983

	Number	Mean	Standard Deviation	Median
Anthropology	89	6.8	2.25	6.6
Art History	29	6.9	2.36	7.1
Economics	150	5.8	1.82	5.4
English	123	6.8	2.68	6.3
German	26	7.7	2.50	8.0
History	139	7.3	2.39	7.0
Mathematics	106	5.7	2.00	5.1
Philosophy	63	6.2	2.14	6.0
Physics	103	5.8	1.54	5.7
Political Science	118	6.2	2.34	5.8
Psychology	180	5.0	1.76	4.5
Spanish	30	8.0	2.31	7.5
Slavic Languages	10	8.4	2.12	8.0
Sociology	142	6.1	2.37	5.6

TABLE 2

DEGREE COMPLETION RATES
SELECTED DEPARTMENTS WITHIN ARTS AND SCIENCES
THE GRADUATE SCHOOL
NORTHWESTERN UNIVERSITY
STUDENTS ENTERING 1972/73 - 1967/77

	MODEL A				MODEL B			
	UNIVERSITY FELLOWS		ALL OTHER STUDENTS		UNIVERSITY FELLOWS		ALL OTHER STUDENTS	
	# OF STUDENTS ENTERING	PERCENT COMPLET-ING PhD	# OF STUDENTS ENTERING	PERCENT COMPLET-ING PhD	# OF STUDENTS ENTERING	PERCENT COMPLET-ING PhD	# OF STUDENTS ENTERING	PERCENT COMPLET-ING PhD
Anthropology	15	46.7	65	33.8	8	50.0	38	34.2
Economics	36	41.7	80	36.3	36	36.1	80	35.0
English	31	35.5	55	14.5	24	33.3	40	20.0
Foreign Languages	8	37.5	40	15.0	5	40.0	23	4.3
History and Art History	23	26.1	81	35.8	13	15.4	53	34.0
Philosophy	14	28.6	21	38.1	13	30.8	17	41.2
Physics and Mathematics	10	60.0	97	40.2	10	60.0	97	38.1
Psychology	9	66.7	69	66.7	9	66.7	69	63.8
Poli Sci and Sociology	23	43.5	105	41.0	20	50.0	83	39.8
Humanities Departments	76	31.6	197	25.9	52	30.8	130	25.4
Social Science Departments	83	45.8	319	43.9	66	45.5	266	41.4
Science Departments	10	60.0	97	40.2	10	60.0	97	38.1

completion rate calculated using Model A is an underestimate of the eventual degree completion rate that would result if all cohorts had 11 years since matriculation in which to earn a degree.

Table 2 also reports degree completion rates computed through the application of an alternative approach labeled Model B. The objective behind Model B is to provide a measure of degree completion based on cohorts with equal lengths of time since initial matriculation. Using Table A1 again as an example, 50 percent of the (four of eight) University Fellows entering between 1972/73 and 1974/75 received Ph.D.'s within nine years of their initial matriculation. In order to obtain cohorts with equal time since matriculation it is necessary to determine the minimum number of years required to permit the majority of those students who will eventually receive their degree to reach that point. Table 1 provides data on the length of time to complete the Ph.D. for all degree recipients in the 14 departments being studied over the period 1970 - 1983. These data are used to establish cut-offs.

A time span that permits at least 75 percent of the eventual degree recipients to obtain a degree is the criterion upon

which the cut-offs are determined. In order to meet this criterion the cut-off must be at least .65 S.D. above the mean time to complete the Ph.D. Using this method seven years is appropriate for Economics, Mathematics, Physics, and Psychology, eight years for Philosophy, Political Science and Sociology and nine years for Anthropology, Art History, English and History. Ten years would be required for the three language departments to meet the test. Since this would result in an insufficient number of cases for meaningful analysis, nine years is used for these departments.

Each model has its strength and weakness as related to the specific question under analysis. Model A permits a larger number of cases to be included in the analysis and consequently provides a more representative picture of what is happening within a discipline. Although Model A produces an underestimate of degree completion rate for the later cohorts, it does so consistently for fellows and nonfellows. Model B, includes a smaller number of cases than Model A by excluding the more recent cohorts completely and it ignores the degrees completed in the later years for the earlier cohorts. Nevertheless, by combining cohorts on an equivalent basis it prevents bias that is created when fellowships are present in some years and absent in others, particularly if

the variation occurs is extreme--as is the case in English with a disproportionately large number of fellowships in 1972/73 (see Table A3).

The data in Table 2 demonstrate a high degree of consistency in the degree completion rates calculated by both models. Although there are differences in the magnitudes, in all cases in which fellows finish in higher percentages than other students as measured by Model A the same result is found with Model B. In regard to the fundamental question posed in the study the data show a reasonably consistent pattern of University Fellows finishing in higher proportions than other students. The two exceptions are for History/Art History and Philosophy. As with the other results this relationship holds when measured using either Model A or Model B.

The last three lines of Table 2 combine the departments by academic division, humanities, social science and science. Across divisions a pattern similar to the departmental result is seen. Even in the humanities where two departments show a result counter to what is expected, when added together the degree completion rate for the division is consistent with the general pattern of fellows finishing in higher proportions than nonfellows.

A chi-square test of significance was applied to each of the pairs of proportions to determine if the differences are statistically significant. With the exception of English as measured by Model A, none of the results are statistically significant at the p=.05 level.

Tables 3 and 4 display the results from the short-term longitudinal model. Both tables show the number of students entering and the number still eligible for the degree as of the Winter Quarter 1983/84. These data are presented separately for fellows and nonfellows and summed by year. The bottom line of each table reflects the totals for the two years included in that table. In the long-term longitudinal approach the grouping of departments is only done on a limited basis. In this approach there is a strong rationale for grouping all departments together. While completion of the Ph.D. degree is a function of fulfilling a dissertation requirement the nature of which varies greatly from department to department, the determination of eligibility in the near term is a result of fulfilling Graduate School requirements which are applied uniformly across departments. Eligibility for the 1978/79 and 1979/80 cohorts is determined in a different manner than for the 1980/81 and 1981/82 cohorts since the criteria for eligibility depend on the

TABLE 3

PERSISTENCE IN DOCTORAL PROGRAMS
SELECTED DEPARTMENTS WITHIN ARTS AND SCIENCES
THE GRADUATE SCHOOL
NORTHWESTERN UNIVERSITY
1978/79 - 1979/80

	University Fellows				All Other Students			
	1978/79				1978/79			
	Entered	Elig	Not Elig	Percent Elig	Entered	Elig	Not Elig	Percent Elig
Anthropology	7	4	3		11	4	7	
Art History	1	1	0		4	3	1	
Economics	6	4	2		15	7	8	
English	4	1	3		7	3	4	
German	2	1	1		1	1	0	
History	2	2	0		4	3	1	
Mathematics	1	1	0		6	3	3	
Philosophy	8	2	6		4	1	3	
Physics	3	2	1		11	6	5	
Poli Sci	8	5	3		10	3	7	
Psychology	2	1	1		9	4	5	
Spanish	-	-	-		3	2	1	
Slavic Lang	-	-	-		1	1	0	
Sociology	4	3	1		10	5	5	
	48	27	21	56.3%	96	46	50	47.9%
	1979/80				1979/80			
	Entered	Elig	Not Elig	Percent Elig	Entered	Elig	Not Elig	Percent Elig
Anthropology	2	1	1		4	2	2	
Art History	-	-	-		2	0	2	
Economics	10	9	1		17	9	8	
English	2	1	1		5	1	4	
German	-	-	-		3	2	1	
History	2	2	0		4	3	1	
Mathematics	1	1	0		5	3	2	
Philosophy	2	2	0		5	1	4	
Physics	-	-	-		6	2	4	
Poli Sci	5	2	3		8	5	3	
Psychology	3	1	2		4	4	0	
Spanish	-	-	-		2	1	1	
Slavic Lang	-	-	-		-	-	-	
Sociology	-	-	-		8	6	2	
	27	19	8	70.3%	73	39	34	53.4%
Total 1978/79 - 1979/80	75	46	29	61.3%	169	85	84	50.2%

TABLE 4

PERSISTENCE IN DOCTORAL PROGRAMS
SELECTED DEPARTMENTS WITHIN ARTS AND SCIENCES
THE GRADUATE SCHOOL
NORTHWESTERN UNIVERSITY
1980/81 - 1981/82

	University Fellows				All Other Students			
	1980/81				1980/81			
	Entered	Elig	Not Elig	Percent Elig	Entered	Elig	Not Elig	Percent Elig
Anthropology	12	12	0		10	2	8	
Art History	2	1	1		2	1	1	
Economics	14	8	6		21	9	12	
English	5	2	3		4	2	2	
German	-	-	-		1	0	1	
History	2	2	0		8	4	4	
Mathematics	-	-	-		11	4	7	
Philosophy	6	3	3		2	1	1	
Physics	8	7	1		11	4	7	
Poli Sci	4	3	1		6	5	1	
Psychology	9	6	3		3	2	1	
Spanish	1	1	0		-	-	-	
Slavic Lang	1	1	0		-	-	-	
Sociology	7	6	1		9	4	5	
	71	52	19	73.2%	88	38	50	43.2%
	1981/82				1981/82			
	Entered	Elig	Not Elig	Percent Elig	Entered	Elig	Not Elig	Percent Elig
Anthropology	3	3	0		5	3	2	
Art History	2	2	0		6	5	1	
Economics	14	10	4		18	10	8	
English	2	1	1		5	2	3	
German	2	1	1		2	1	1	
History	4	3	1		2	1	1	
Mathematics	10	8	2		4	3	1	
Philosophy	5	4	1		1	0	1	
Physics	4	4	0		9	6	3	
Poli Sci	6	2	4		10	4	6	
Psychology	14	11	3		8	5	3	
Spanish	-	-	-		-	-	-	
Slavic Lang	-	-	-		-	-	-	
Sociology	1	1	0		7	4	3	
	67	50	17	74.6%	77	44	33	57.1%
Total 1980/81 - 1981/82	138	102	36	73.9%	165	82	83	49.7%

length of time since initial matriculation. Eligibility for the 1978/79 and 1979/80 cohorts is determined by whether or not the student has been admitted to candidacy for the Ph.D. There are a complex set of rules which regulate the admission to candidacy process which must be initiated by the student through his or her department and approved by The Graduate School. While there is some flexibility in the time requirement for gaining admission to candidacy all students must be admitted within 16 quarters of initial enrollment. For both the 1978/79 and 1979/80 cohorts this time limit has passed and eligibility is, therefore, determined by admission to candidacy.

For the 1980/81 and 1981/82 cohorts eligibility is determined by another method since some of the students who have not been admitted to candidacy have not yet exceeded their time limit. The criterion used is whether or not the student is currently registered and has accumulated the appropriate amount of residency credit. In both Tables 3 and 4 there are no percentages next to the individual department tallies. This is done because the number of students in some of the categories is so small as to make the percentages misleading. The appropriate place to focus attention is on the annual totals. Looking at both tables the pattern is clear. For

all annual summaries University Fellows show a higher proportion still eligible than all other students. The differences for each year were subjected to a chi-square test. The difference in the proportion of fellows who are still eligible as compared with the proportion of all other students who are still eligible is not statistically significant for either 1978/79 or 1979/80. For 1980/81 the difference is statistically significant at the p=.01 level and for 1981/82 it is significant at the p=.05 level. When grouped together the 1978/79 - 1979/80 differences are still not significant and while the 1980/81 - 1981/82 grouping is significant at the p=.01 level. When all four years are calculated jointly, the difference in the proportion of fellows who are still eligible shows a statistically significant difference from the proportion of all other students who are eligible at the p=.01 level.

Table 5 presents the result of the retrospective model. In this approach Ph.D. recipients in each department or department group--using the grouping criteria described above--are traced back to their year of entry. Individuals are then classified based on their fellowship status in the year of entry and length of time to complete a Ph.D. is calculated for each group. As with the earlier data from the cohort

TABLE 5

LENGTH OF TIME TO COMPLETE A PHD
SELECTED DEPARTMENTS WITHIN ARTS AND SCIENCES
THE GRADUATE SCHOOL
NORTHWESTERN UNIVERSITY
1978 - 1983

	University Fellows				All Other Students			
	Number	Mean	Standard Deviation	Median	Number	Mean	Standard Deviation	Median
Anthropology	9	5.6	2.74	5.0	36	7.8	2.04	7.8
Economics	18	6.4	1.54	6.0	49	5.4	1.81	5.0
English	9	6.9	1.90	6.8	22	8.8	2.91	9.0
Foreign Languages	5	8.4	2.30	8.0	22	8.6	2.44	8.8
History and Art History	12	7.8	2.01	7.5	49	8.5	2.34	8.3
Philosophy	5	6.8	1.30	7.0	14	6.5	2.35	5.5
Physics and Mathematics	9	6.0	1.80	6.0	49	6.4	1.85	5.9
Psychology	6	5.3	1.21	5.5	58	5.7	1.87	5.3
Poli Sci and Sociology	8	6.1	1.96	6.5	63	6.4	2.29	6.0

models the results of the retrospective model reflect a pattern in which University Fellows require a shorter length of time to complete a Ph.D. than students who were not University Fellows in their first year. However, this pattern does not hold for all departments nor is the result identical for both mean and median time to degree. Both means and medians are computed as neither measure can completely describe a distribution. The Departments of Economics and Philosophy experience the opposite of the expected result with students without university fellowships finishing more rapidly than those with fellowships on both measures. Two other groups, Physics/Mathematics and Psychology show a slightly longer median time to degree for fellows although the result using the mean is in the expected direction. A t-test of the statistical significance of differences in means was applied to the data for the seven department/groupings in which the relationship was in the expected direction. Two of these, Anthropology and English show statistically significant results at the p=.05 level.

Conclusions

In brief the data does not provide strong support for the hypothesis that students awarded university fellowships in their first year consistently outperform all other students.

Inspection of the data does indicate a general pattern of fellows having higher degree completion rates and taking a shorter period of time to complete the degree than nonfellows. When subjected to statistical testing to determine if these differences are significant the result is that only in isolated instances are the differences significant at the p=.05 level. The notable exception is the Department of English, where both the long-term longitudinal approach and the retrospective approach show statistically significant higher performance of fellows compared with nonfellows. On the other hand there are instances where the data indicated superior performance of nonfellows over fellows.

There are several factors that complicate the relationship and help explain the absence of statistically significant differences in the length of time to complete the degree and the proportion of degree completers for students awarded fellowships in their first year of graduate study compared with those not receiving fellowships. The first complication is that the financial aid, independent of the quality of a student, can affect the probability completing a degree and the time required to complete the degree. In one respect the availability of financial support which requires no service obligation on the part of the student may allow that individual

to complete a degree more rapidly than someone who has aid which carries a service obligation, such as an assistantship. Confounding this is the impact that aid alone would have on the financial resources necessary for an individual to stay in graduate school and consequently complete a degree. These factors would tend to work in the same direction suggested by the hypothesis under study and, consequently, must be rejected along with the hypothesis. This is not unexpected because the method for distributing financial aid to graduate students at Northwestern University and the nature of the service requirements associated with the aid are such that these factors are not likely to affect the outcome. Fellowships are awarded for one year only and generally continued support comes in the form of service related aid provided through the individual departments. In addition the service related aid provided to graduate students more often than not is supportive of their academic work and consequently is not likely to slow an individual's progress toward a degree.

Two alternative hypotheses exist which can explain the results obtained. The first of these is that through the merit based award system the fellowship selection committee is identifying and rewarding those individuals who will

produce higher quality graduate work. While this is an interesting argument it is empirically a very difficult one to evaluate. Grades are not used as a measure of performance in this study because it is felt that they reflect only a small aspect of student performance which is of limited importance in indicating a successful graduate student. A specific measure of quality which would provide a better indicator of overall performance would be an evaluation of the quality of the dissertation. Unfortunately, this evaluation is not possible at the current time but is contemplated for the future.

A final complication to the analysis, and in the view of this author, the best explanation of the lack of statistically significant differences in performance of fellows and nonfellows is that success in graduate school as indicated by degree completion rates and time to completion is a function of persistence rather than academic ability. Academic capability is a necessary condition for success, but exogenous economic factors and psychological determinants play a significant role. The fellowship selection committee is, through a careful evaluative process, identifying a subset of students who are somewhat more capable of success than the general population of graduate students. Then if persistence

is normally distributed, the fellowship group which is more capable would perform marginally better than the nonfellowship group. However, since under this hypothesis the persistence is the causal element the simple relationship between ability and performance would not exist. A direct test of the persistence hypothesis is very difficult. Future research will focus on measures of ability other than those arrived at through the deliberations of the fellowship committee. In this manner a more complete assessment of the impact of ability factors can be made.

Educational Implications

This study is significant in a number of ways. From an institutional point of view it provides data and statistical analysis of the work of the fellowship selection committee. It suggests particular disciplines in which the selection criteria used by the committee should be reassessed because the result is opposite of what is expected. Even where the results are consistent with expectation they suggest that a broader set of criteria in addition to the ones currently being used by the committee should be considered in the selection process. These criteria should be related to the nonacademic determinants of persistence.

In a broader educational context this study provides additional insight into the issues of the appropriate criteria of performance. Follow-up studies using the same data base as this project will focus both on selection and performance criteria. Longitudinal studies in which the quality of the dissertation and professional performance are related to the full range of selection criteria included in the data base are contemplated. This will provide additional information to extend the significant work started by Centra and Clark (1982) and Hartnett and Willingham (1979).

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TABLE A1

DEGREE COMPLETION RATES

DEPARTMENT OF ANTHROPOLOGY
NORTHWESTERN UNIVERSITY

	ENTERED	YEARS SINCE MATRICULATION 3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	4			1		1				1	3	75.0
1973/74										--		
1974/75	4		1	1					--	--	2	50.0
1975/76	5						1	--	--	--	1	20.0
1976/77	2				1		--	--	--	--	1	50.0
TOTAL	15	0	1	2	1	1	1	0	0	1	7	46.7
CUMULATIVE TOTAL		0	1	3	4	5	6	6	6	7		
CUMULATIVE %			6.67	20.0	26.7	33.3	40.0	40.0	40.0	46.7		
1972/73-1974/75 TOTAL	8	0	1	2	0	1	0	0				
CUMULATIVE TOTAL		0	1	3	3	4	4	4				
CUMULATIVE %			12.5	37.5	37.5	50.0	50.0	50.0				
ALL OTHER STUDENTS												
1972/73	15	1	1		3		1				6	40.0
1973/74	19				1		3		2	--	6	31.6
1974/75	4					1	2		--	--	3	75.0
1975/76	19				1	2	2	--	--	--	5	26.3
1976/77	8		1		1		--	--	--	--	2	25.0
TOTAL	65	1	2	0	6	3	8	0	2	0	22	33.8
CUMULATIVE TOTAL		1	3	3	9	12	20	20	22	22		
CUMULATIVE %			4.62	4.62	13.8	18.5	30.8	30.8	33.8	33.8		
1972/73-1974/75 TOTAL	38	1	1	0	4	1	6	0				
CUMULATIVE TOTAL		1	2	2	6	7	13	13				
CUMULATIVE %			5.26	5.26	15.8	18.4	34.2	34.2				

TABLE A2

DEGREE COMPLETION RATES

DEPARTMENT OF ECONOMICS
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
						UNIVERSITY FELLOWS						
1972/73	10				2	1	1		1		5	50.0
1973/74	3			1	1					--	2	66.7
1974/75	7			2	1				--	--	3	42.9
1975/76	5							--	--	--	0	0.0
1976/77	11			3		2	--	--	--	--	5	45.5
TOTAL	36	0	0	6	4	3	1	0	1	0	15	41.7
CUMULATIVE TOTAL		0	0	6	10	13	14	14	15	15		
CUMULATIVE %				16.7	27.8	36.1	38.9	38.9	41.7	41.7		
						ALL OTHER STUDENTS						
1972/73	15			1	1						2	13.3
1973/74	21			5	1	1		1		--	8	38.1
1974/75	16	1	2	1	2				--	--	6	37.5
1975/76	17		5	1	2	1		--	--	--	9	52.9
1976/77	11		1	1	1	1	--	--	--	--	4	36.4
TOTAL	80	1	8	9	7	3	0	1	0	0	29	36.3
CUMULATIVE TOTAL		1	9	18	25	28	28	29	29	29		
CUMULATIVE %			11.3	22.5	31.3	35.0	35.0	36.3	36.3	36.3		

TABLE A3

DEGREE COMPLETION RATES

DEPARTMENT OF ENGLISH
NORTHWESTERN UNIVERSITY

	ENTERED	YEARS SINCE MATRICULATION 3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	12			3	1				1		5	41.7
1973/74	7			1		1				--	2	28.6
1974/75	5				1		1		--	--	2	40.0
1975/76	3							--	--	--	0	0.0
1976/77	4		1			1	--	--	--	--	2	50.0
TOTAL	31	0	1	4	2	2	1	0	1	0	11	35.5
CUMULATIVE TOTAL		0	1	5	7	9	10	10	11	11		
CUMULATIVE %			3.23	16.1	22.6	29.0	32.3	32.3	35.5	35.5		
1972/73-1974/75												
TOTAL	24	0	0	4	2	1	1	0				
CUMULATIVE TOTAL		0	0	4	6	7	8	8				
CUMULATIVE %				16.7	25.0	29.2	33.3	33.3				
ALL OTHER STUDENTS												
1972/73	12			2		1					3	25.0
1973/74	13						1	1		--	2	15.4
1974/75	15					1	1	1	--	--	3	20.0
1975/76	1							--	--	--	0	0.0
1976/77	14						--	--	--	--	0	0.0
TOTAL	55	0	0	2	0	2	2	2	0	0	8	14.5
CUMULATIVE TOTAL		0	0	2	2	4	6	8	8	8		
CUMULATIVE %				3.64	3.64	7.27	10.9	14.5	14.5	14.5		
1972/73-1974/75												
TOTAL	40	0	0	2	0	2	2	2				
CUMULATIVE TOTAL		0	0	2	2	4	6	8				
CUMULATIVE %				5.00	5.00	10.0	15.0	20.0				

TABLE A4

DEGREE COMPLETION RATES

SELECTED LANGUAGE DEPARTMENTS
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	3							1			1	33.3
1973/74										--		
1974/75	2					1			--	--	1	50.0
1975/76	1							--	--	--	0	0.0
1976/77	2				1		--	--	--	--	1	50.0
TOTAL	8	0	0	0	1	1	0	1	0	0	3	37.5
CUMULATIVE TOTAL		0	0	0	1	2	2	3	3	3		
CUMULATIVE %					12.5	25.0	25.0	37.5	37.5	37.5		
1972/73-1974/75 TOTAL	5	0	0	0	0	1	0	1				
CUMULATIVE TOTAL		0	0	0	0	1	1	2				
CUMULATIVE %						20.0	20.0	40.0				
ALL OTHER STUDENTS												
1972/73	9								1		1	11.1
1973/74	9									--	0	0.0
1974/75	5					1			--	--	1	20.0
1975/76	11			1				--	--	--	1	9.9
1976/77	6					3	--	--	--	--	3	50.0
TOTAL	40	0	0	1	0	4	0	0	1	0	6	15.0
CUMULATIVE TOTAL		0	0	1	1	5	5	5	6	6		
CUMULATIVE %				2.5	2.5	12.5	12.5	12.5	15.0	15.0		
1972/73-1974/75 TOTAL	23	0	0	0	0	1	0	0				
CUMULATIVE TOTAL		0	0	0	0	1	1	1				
CUMULATIVE %						4.35	4.35	4.35				

TABLE A5

DEGREE COMPLETION RATES

DEPARTMENTS OF
HISTORY AND ART HISTORY
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
						UNIVERSITY FELLOWS						
1972/73	7								2		2	28.6
1973/74	2				1					--	1	50.0
1974/75	4					1			--	--	1	25.0
1975/76	5			1				--	--	--	1	20.0
1976/77	5			1			--	--	--	--	1	20.0
TOTAL	23	0	0	2	1	1	0	0	2	0	6	26.1
CUMULATIVE TOTAL		0	0	2	3	4	4	4	6	6		
CUMULATIVE %				8.70	13.0	17.4	17.4	17.4	26.1	26.1		
1972/73-1974/75												
TOTAL	13	0	0	0	1	1	0	0				
CUMULATIVE TOTAL		0	0	0	1	2	2	2				
CUMULATIVE %					7.69	15.4	15.4	15.4				
						ALL OTHER STUDENTS						
1972/73	21		1	1	1			1	1		5	23.8
1973/74	14				1	1		3		--	5	35.7
1974/75	18			1	1	3	1	3	--	--	9	50.0
1975/76	11				1	2	1	--	--	--	4	36.4
1976/77	17		1	1	2	2	--	--	--	--	6	35.3
TOTAL	81	0	2	3	6	8	2	7	1	0	29	35.8
CUMULATIVE TOTAL		0	2	5	11	19	21	28	29	29		
CUMULATIVE %			2.47	6.17	13.6	23.5	25.9	34.6	35.8	35.8		
1972/73-1974/75												
TOTAL	53	0	1	2	3	4	1	7				
CUMULATIVE TOTAL		0	1	3	6	10	11	18				
CUMULATIVE %			1.89	5.66	11.3	18.9	20.8	34.0				

TABLE A6

DEGREE COMPLETION RATES

DEPARTMENT OF PHILOSOPHY
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	6						2				2	33.3
1973/74	2				1	1				--	2	100.0
1974/75	2								--	--	0	0.0
1975/76	3							--	--	--	0	0.0
1976/77	1						--	--	--	--	0	0.0
TOTAL	14	0	0	0	1	1	2	0	0	0	4	28.6
CUMULATIVE TOTAL		0	0	0	1	2	4	4	4	4		
CUMULATIVE %					7.14	14.3	28.6	28.6	28.6	28.6		
1972/73-1975/76 TOTAL	13	0	0	0	1	1	2					
CUMULATIVE TOTAL		0	0	0	1	2	4					
CUMULATIVE %					7.69	15.4	30.8					
ALL OTHER STUDENTS												
1972/73	5			2							2	40.0
1973/74	5			3						--	3	60.0
1974/75	4						1		--	--	1	25.0
1975/76	3		1					--	--	--	1	33.3
1976/77	4			1			--	--	--	--	1	25.0
TOTAL	21	0	1	6	0	0	1	0	0	0	8	38.1
CUMULATIVE TOTAL		0	1	7	7	7	8	8	8	8		
CUMULATIVE %			4.76	33.3	33.3	33.3	38.1	38.1	38.1	38.1		
1972/73-1975/76 TOTAL	17	0	1	5	0	0	1					
CUMULATIVE TOTAL		0	1	6	6	6	7					
CUMULATIVE %			5.88	35.3	35.3	35.3	41.2					

TABLE A7

DEGREE COMPLETION RATES

DEPARTMENTS OF
MATHEMATICS AND PHYSICS
NORTHWESTERN UNIVERSITY

	ENTERED	YEARS SINCE MATRICULATION 3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	7		1		2						3	42.9
1973/74										--		
1974/75									--	--		
1975/76	1				1			--	--	--	1	100.0
1976/77	2				2		--	--	--	--	2	100.0
TOTAL	10	0	1	0	5	0	0	0	0	0	6	60.0
CUMULATIVE TOTAL		0	1	1	6	6	6	6	6	6		
CUMULATIVE %			10.0	10.0	60.0	60.0	60.0	60.0	60.0	60.0		
ALL OTHER STUDENTS												
1972/73	14		3	2	1	1					7	50.0
1973/74	22	1	1	4		1				--	7	31.8
1974/75	21			2	4	3	1		--	--	10	47.6
1975/76	13			5		2	1	--	--	--	8	61.5
1976/77	27			3	3	1	--	--	--	--	7	25.9
TOTAL	97	1	4	16	8	8	2	0	0	0	39	40.2
CUMULATIVE TOTAL		1	5	21	29	37	39	39	39	39		
CUMULATIVE %			5.15	21.6	29.9	38.1	40.2	40.2	40.2	40.2		

TABLE A8

DEGREE COMPLETION RATES

DEPARTMENT OF PSYCHOLOGY
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										PHD'S
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	1		1								1	100.0
1973/74	1		1							--	1	100.0
1974/75	2			1		1			--	--	2	100.0
1975/76	4		1		1			--	--	--	2	50.0
1976/77	1						--	--	--	--	0	0.0
TOTAL	9	0	3	1	1	1	0	0	0	0	6	66.7
CUMULATIVE TOTAL		0	3	4	5	6	6	6	6	6		
CUMULATIVE %			33.3	44.4	55.6	66.7	66.7	66.7	66.7	66.7		
ALL OTHER STUDENTS												
1972/73	16	1	2	4		1					8	50.0
1973/74	12	1	4	1	2					--	8	66.7
1974/75	18	1	3	2	4	1	1	1	--	--	13	72.2
1975/76	11	1	3	1	1	1		--	--	--	7	63.6
1976/77	12		2	3	4	1	--	--	--	--	10	83.3
TOTAL	69	4	14	11	11	4	1	1	0	0	46	66.7
CUMULATIVE TOTAL		4	18	29	40	44	45	46	46	46		
CUMULATIVE %			26.1	42.0	58.0	63.8	65.2	66.7	66.7	66.7		

TABLE A9

DEGREE COMPLETION RATES

DEPARTMENTS OF
POLITICAL SCIENCE AND SOCIOLOGY
NORTHWESTERN UNIVERSITY

	ENTERED	YEARS SINCE MATRICULATION 3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	4			2	1	1					4	100.0
1973/74	7		2							--	2	28.6
1974/75	6	1					1		--	--	2	33.3
1975/76	3			1			1	--	--	--	2	66.7
1976/77	3						--	--	--	--	0	0.0
TOTAL	23	1	2	3	1	1	2	0	0	0	10	43.5
CUMULATIVE TOTAL		1	3	6	7	8	10	10	10	10		
CUMULATIVE %			13.0	26.1	30.4	34.8	43.5	43.5	43.5	43.5		
1972/73-1975/76 TOTAL	20	1	2	3	1	1	2					
CUMULATIVE TOTAL		1	3	6	7	8	10					
CUMULATIVE %			15.0	30.0	35.0	40.0	50.0					
ALL OTHER STUDENTS												
1972/73	17		5				1			1	7	41.2
1973/74	20	1	2	1	3	1	3		1	--	12	60.0
1974/75	18	1	1	1	4	1	1		--	--	9	50.0
1975/76	28	3	1	1	1		1	--	--	--	7	25.0
1976/77	22		1	2	3	2	--	--	--	--	8	36.4
TOTAL	105	5	10	5	11	4	6	0	1	1	43	41.0
CUMULATIVE TOTAL		5	15	20	31	35	41	41	42	43		
CUMULATIVE %			14.3	19.0	29.5	33.3	39.0	39.0	40.0	41.0		
1972/73-1975/76 TOTAL	83	5	9	3	8	2	6					
CUMULATIVE TOTAL		5	14	17	25	27	33					
CUMULATIVE %			16.9	20.5	30.1	32.5	39.8					

TABLE A10

DEGREE COMPLETION RATES

HUMANITIES DEPARTMENTS COMBINED
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
						UNIVERSITY FELLOWS						
1972/73	28			3	1		2	1	3		10	35.7
1973/74	11			1	2	2				--	5	45.5
1974/75	13				1	2		1	--	--	4	30.8
1975/76	12			1				--	--	--	1	8.3
1976/77	12		1	1	1	1	--	--	--	--	4	33.3
TOTAL	76	0	1	6	5	5	2	2	3	0	24	31.6
CUMULATIVE TOTAL		0	1	7	12	17	19	21	24	24		
CUMULATIVE %			1.32	9.21	15.8	22.4	25.0	27.6	31.6	31.6		
1972/73-1974/75												
TOTAL	52	0	0	4	4	4	2	2				
CUMULATIVE TOTAL		0	0	4	8	12	14	16				
CUMULATIVE %				7.69	15.4	23.1	26.9	30.8				
						ALL OTHER STUDENTS						
1972/73	47		1	5	1	1		1	2		11	23.4
1973/74	41			3	1	1	1	4		--	10	24.4
1974/75	42			1	1	5	3	4	--	--	14	33.3
1975/76	26		1	1	1	2	1	--	--	--	6	23.1
1976/77	41	1	2	2	5		--	--	--	--	10	24.4
TOTAL	197	1	4	12	9	9	5	9	2	0	51	25.9
CUMULATIVE TOTAL		1	5	17	26	35	40	49	51	51		
CUMULATIVE %			2.54	8.63	13.2	17.8	20.3	24.9	25.9	25.9		
1972/73-1974/75												
TOTAL	130	0	1	9	3	7	4	9				
CUMULATIVE TOTAL		0	1	10	13	20	24	33				
CUMULATIVE %			0.77	7.69	10.0	15.4	18.5	25.4				

TABLE A11

DEGREE COMPLETION RATES

SOCIAL SCIENCE DEPARTMENTS COMBINED
NORTHWESTERN UNIVERSITY

		YEARS SINCE MATRICULATION										
	ENTERED	3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
						UNIVERSITY FELLOWS						
1972/73	19		1	3	3	3	1		1	1	13	68.4
1973/74	11		3	1	1					--	5	45.5
1974/75	19	1	1	4	1	1	1		--	--	9	47.4
1975/76	17		1	1	1		2	--	--	--	5	29.4
1976/77	17			3	1	2	--	--	--	--	6	35.3
TOTAL	83	1	6	12	7	6	4	0	1	1	38	45.8
CUMULATIVE TOTAL		1	7	19	26	32	36	36	37	38		
CUMULATIVE %			8.43	22.9	31.3	38.6	43.4	43.4	44.6	45.8		
1972/73-1975/76												
TOTAL	66	1	6	9	6	4	4					
CUMULATIVE TOTAL		1	7	16	22	26	30					
CUMULATIVE %			10.6	24.2	33.3	39.4	45.5					
						ALL OTHER STUDENTS						
1972/73	63	2	8	5	4	1	2			1	23	36.5
1973/74	72	2	6	7	7	2	6	1	3	--	34	47.2
1974/75	56	3	6	4	10	3	4	1	--	--	31	55.4
1975/76	75	4	9	3	5	4	3	--	--	--	28	37.3
1976/77	53		5	6	9	4	--	--	--	--	24	45.3
TOTAL	319	11	34	25	35	14	15	2	3	1	140	43.9
CUMULATIVE TOTAL		11	45	70	105	119	134	136	139	140		
CUMULATIVE %			14.1	21.9	32.9	37.3	42.0	42.6	43.6	43.9		
1972/73-1975/76												
TOTAL	266	11	29	19	26	10	15					
CUMULATIVE TOTAL		11	40	59	85	95	110					
CUMULATIVE %			15.0	22.2	32.0	35.7	41.4					

TABLE A12

DEGREE COMPLETION RATES

SCIENCE DEPARTMENTS COMBINED
NORTHWESTERN UNIVERSITY

	ENTERED	YEARS SINCE MATRICULATION 3	4	5	6	7	8	9	10	11	TOTAL PHD'S	PHD'S AS % OF ENTERED
UNIVERSITY FELLOWS												
1972/73	7		1		2						3	42.9
1973/74										--		
1974/75									--	--		
1975/76	1				1			--	--	--	1	100.0
1976/77	2				2		--	--	--	--	2	100.0
TOTAL	10	0	1	0	5	0	0	0	0	0	6	60.0
CUMULATIVE TOTAL		0	1	1	6	6	6	6	6	6		
CUMULATIVE %			10.0	10.0	60.0	60.0	60.0	60.0	60.0	60.0		
ALL OTHER STUDENTS												
1972/73	14		3	2	1	1					7	50.0
1973/74	22	1	1	4		1				--	7	31.8
1974/75	21			2	4	3	1		--	--	10	47.6
1975/76	13			5		2	1	--	--	--	8	61.5
1976/77	27			3	3	1	--	--	--	--	7	25.9
TOTAL	97	1	4	16	8	8	2	0	0	0	39	40.2
CUMULATIVE TOTAL		1	5	21	29	37	39	39	39	39		
CUMULATIVE %			5.15	21.6	29.9	38.1	40.2	40.2	40.2	40.2		